THE

CATECHISM OF NATURE;

FOR THE USE OF

CHILDREN.

By DOCTOR MARTINET,

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TRANSLATED FROM THE DUTCH,

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"READ NATURE; NATURE IS A FRIEND TO TRUTH."
YOUNG.

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ADVERTISEMENT.

THE alterations which have been made in this little work, with the omiſſion of ſome queſtions, and the addition of others, were judged neceſſary to procure it a more general reception, and to make it more extenſively uſeful. If this meets with the public favour, it is the Tranſlator's intention to undertake the Profeſſor's larger work, which bears the ſame title as the ſmaller one. 'Katechiſmus der Natuur,' in four volumes in octavo. It has gone through five editions, and is deſigned for perſons of riper years.

J. H.

Rotterdam,
Mar. 1, 1790.

THE

CATECHISM OF NATURE.

INTRODUCTORY DIALOGUE.

TUTOR.

THE firſt grand object of your inquiry, my dear pupil, is, God your Creator.

PUPIL.

How may I acquire a knowledge of my Creator?

TUT. From his works, and from his word.

PUP. Has not God revealed himſelf to us in the Bible?

TUT. Without doubt. But when you can ſee, as it were, with your own eyes, his adorable perfections, it is certainly your duty to view his works, as well as to read his word.

PUP. Has this been the practice of wiſe and good men in former ages?

TUT. Yes; Moſes, Job, David, Iſaiah, and others. Solomon in particular, we find, ſpoke of trees, of beaſts, of fowls, of creeping things, and of fiſhes. The Saviour himſelf alſo has directed

our

our attention to the works of nature. "Behold the fowls of the air! conſider the lilies of the field, how they grow!"

PUP. What may I expect from contemplating the works of nature?

TUT. Both profit and pleaſure. As God has formed the eye to behold the beauties of nature, it muſt be both agreeable and uſeful.

PUP. Is not this a pleaſure confined to the learned?

TUT. By no means; the peaſant as well as the philoſopher may partake of this pleaſure. A moderate ſhare of knowledge is ſufficient. The creation is open to the view of all; it only requires obſervation.

PUP. What may I expect to find in the works of God?

TUT. Whatever is wiſe, great, good, and perfect. God beheld every thing that he had made, and ſaw that it was good.

DIALOGUE II.

ON THE FIRMAMENT AND THE HEAVENLY BODIES.

PUPIL. Which of the works of God ſhould firſt engage my attention?

TUTOR. Turn your eyes up to the firmament, that wide boundleſs ſpace, in which are fixed the ſun, the moon, the planets, the comets, and the ſtars.

Pup. What are the principal qualities of the firmament?

Tut. Extent and tranſparency. It muſt be very extenſive to contain the innumerable heavenly lights; and tranſparent, otherwiſe we could not ſee them; its extent cannot be computed; and the tranſparency of the firmament is equally amazing.

Pup. What ſtars are thoſe which we ſee in a clear evening?

Tut. They are great bodies of fire, like our ſun, but on account of their immenſe diſtance appear ſo very ſmall.

Pup. How many ſtars are there in the firmament?

Tut. The number we ſee with the naked eye is not conſiderable: but, as the better our glaſſes are, the more we ſee: to ſpeak in the language of men, "they are innumerable."

Pup. Why do they twinkle?

Tut. That appearance is occaſioned by intervening vapours floating in the air.

Pup. The ſtars appear to be placed without any order.

Tut. They appear ſo, becauſe we ſee them but in one point of view; but they are certainly arranged in the moſt exact and beautiful order; for they were arranged by God, who is order and beauty itſelf.

Pup. Were the ſtars created only for our uſe?

Tut. It is unreaſonable to ſuppoſe it, on account of their vaſt diſtance: but they were probably created to enlighten other worlds, as the ſun enlightens ours.

Pup. Are the ſtars then ſuns like ours?

Tut. Yes, ſuch is the common prevailing opinion of philoſophers.

Pup. Are they in no degree ſerviceable to us?

Tut. They ſerve to enlarge our ideas of the works of God, and to diminiſh the gloom of darkneſs: they are of great uſe alſo to mariners; that one particularly, which is called the north pole ſtar, and always has one and the ſame poſition in the heavens.

Pup. But let us ſpeak of our own ſun, if you pleaſe, ſir, and of our own ſyſtem. How large is the ſun?

Tut. Ten hundred thouſand times larger than our earth.

Pup. How far do you ſuppoſe the ſun to be from the earth.

Tut. Ninety-five million one hundred and ſeventy three thouſand Engliſh miles.

Pup. What an amazing diſtance! Would it not be better, if the ſun was nearer us?

Tut. Our all-wiſe Creator could not miſtake. He has exactly adjuſted its proper place: if it were nearer, we ſhould be burnt; if farther off, we ſhould periſh with cold.

PUP. What benefit do we receive from the ſun, beſide its affording us light?

TUT. By its warmth and heat it promotes vegetation, cheriſhes animal life, and raiſes the vapours from the ſea, without which we ſhould have no rain.

PUP. Of what nature, or quality, is light?

TUT. It is an emanation of rays from the ſun, ſpreading themſelves with inconceivable velocity through the ether. Light is exceedingly fine and ſubtile; it penetrates through glaſs, and is diffuſed over the whole world.

PUP. How does it appear that the rays of the ſun partake of the nature of fire?

TUT. It appears from hence, that when collected in a burning glaſs, they produce ſimilar effects, and will ſet things on fire.

PUP. Is there any thing more particular in theſe rays?

TUT. They are the cauſe of all the different colours we ſee, of the morning and evening twilight, and of the light coming into our houſes.

PUP. What am I to underſtand by the morning or evening twilight?

TUT. The gradual ſlow increaſe and decreaſe of the ſun's light; without which we ſhould paſs inſtantly out of dark night into clear day, and the light would as ſuddenly leave us.

PUP. Would that be prejudicial?

TUT. Such a ſudden tranſition as the former would be dangerous to the eye; and the latter would often perplex and diſtreſs us: againſt both theſe inconveniences God has wiſely provided, by the twilight.

DIALOGUE III.

THE SAME SUBJECT CONTINUED.

Pup. Are there not other lights in the firmament?

Tut. Yes: but they ſhine only with borrow'd light, and are called planets.

Pup. What are the names of thoſe planets?

Tut. That, which is neareſt the ſun, we call Mercury; the next Venus; then comes our Earth with its moon: ſtill farther from it, are Mars, Jupiter, and Saturn, with their moons, which are all enlightened by the ſun.

Pup. Has not a new planet been lately diſcovered?

Tut. Yes, by that celebrated aſtronomer, Mr. Herſchel; who has called it, in honour of his royal patron, Georgium Sidus.

Pup. Our earth has a moon; have the other planets moons too?

Tut. Jupiter has four, Saturn ſeven, and Georgium Sidus two, as lately diſcovered by Mr. Herſchel's new-invented teleſcope. Some have thought that Venus has a moon, as Fontana, and Caſſini:

and Short, in the year 1740, ſaw an illuminated ſpeck near this planet, which he ſuppoſed to be its moon. Three French aſtronomers ſaw the ſame in the years 1761, and 1765.

PUP. How are thoſe planets to be diſtinguiſhed from the ſtars?

TUT. The ſtars twinkle: the planets ſhine with a ſteady light. The planets alſo are continually changing their poſitions in the heavens; but the ſtars keep their reſpective places, and are therefore called the fixed ſtars.

PUP. In what manner do the planets move?

TUT. They all move round the ſun; but not in the ſame orbit, nor in the ſame time.

PUP. In what time does the earth move round the ſun?

TUT. In three hundred and ſixty-five days, which makes our year: and though it revolves with incredible ſwiftneſs, we are yet inſenſible of its motion.

PUP. Why are we inſenſible of its motion?

TUT. Becauſe the air which encircles the earth (which we call the atmoſphere) is carried along with it; and all ſurrounding objects move with us at the ſame time.

PUP. Why is it not always equally warm?

TUT. The inclination of the earth's axis, as it moves round the ſun, is the occaſion of the various ſeaſons; Spring, Summer, Autumn, and Winter.

This I ſhall explain to you in my future lecture on aſtronomy.

PUP. Has the earth any other motion?

TUT. Beſide that round the ſun, which we call its annual revolution, it has another motion round its own axis, once in twenty-four hours, which makes our day and night; this we call its diurnal revolution.

PUP. Does the moon move round the earth?

TUT. Yes, in twenty-four days, and continually attends upon the earth, during its whole revolution round the ſun.

PUP. Why do we not always ſee the moon?

TUT. When it is on that ſide of the earth next the ſun, then the dark ſide of the moon is towards us, for which reaſon we are not able to ſee it.

PUP. What am I to underſtand by an eclipſe?

TUT. When the moon's ſhadow falls upon the earth, we call that an eclipſe of the ſun, becauſe the moon prevents our ſeeing the ſun, more or leſs, according to the extent of its ſhade. And when the ſhadow of the earth falls upon the moon, we call that an eclipſe of the moon. Obſerve, an eclipſe of the moon can only happen when it is full moon, and an eclipſe of the ſun when it is new moon.

PUP. As the moon, you ſay, is a dark body of itſelf, do we receive any benefit from it?

TUT. Yes, from its reflecting to our earth the ſun's light; which is ſo particularly pleaſing and uſeful during the long dark nights of winter: what a ſingular mark of the divine goodneſs, thus to provide for us in the abſence of the ſun!

PUP. Have we any other advantage from the moon?

TUT. Yes, it is, together with the ſun, the cauſe of the ebbing and flowing of the ſea, which tends to purify it; and the tides are very uſeful for navigation.

PUP. Is the moon inhabited?

TUT. Some philoſophers ſuppoſe it is; and that our earth ſerves as a moon to them. For you may ſee plainly yourſelf, that our earth reflects the ſun's light on that ſide which is not illuminated: this you may perceive every new moon; but more in the winter than the ſummer months.

PUP. Do you alſo ſuppoſe then, the planets of other ſyſtems, to which the ſtars are ſuns, are inhabited?

TUT. Without doubt. Such an idea is truly philoſophical, grounded upon reaſon and analogy. As there is ſuch an amazing variety and gradation in the animal ſpecies, ſo it is not to be ſuppoſed that angels and men are the only intelligent beings in the univerſe.

PUP. But might we not expect the Bible to have given us ſome light upon this ſubject?

TUT. The Bible was not deſigned to teach us aſtronomy, geometry, or mathematics. It gives us a minute relation of the formation of our own ſyſtem—and that the other parts of the univerſe are innumerable. Philoſophical reſearches ſoar above the level of common underſtandings. Moral truth is of more intrinſic value—and an humble, obedient heart—worth all the ſtores of human learning.—But we are loſing ſight of our ſubject. What queſtion did you next deſign to aſk me?

Pup. What idea am I to form of the comets; are they bodies of fire?

Tut. No. They receive their light from the ſun, which is apparent from their ſhining trains.

Pup. Are not thoſe trains, or tails, fire?

Tut. They are conjectured to be only their atmoſpheres, enlightened by the ſun.

Pup. Are not the comets ſuppoſed to paſs far beyond the limits of our ſyſtem?

Tut. Yes, which ſerves to give us a very enlarged idea of the extent of the firmament. The period of that comet's revolution which appeared in 1759, was computed at about ſeventy years. And that which was ſeen in 1680, has been ſhewn to have a period of more than five hundred years. The orbits of more than fifty comets have been fixed with ſufficient accuracy to aſcertain when they may be expected to appear again.

Pup. Are the comets ſuppoſed to be inhabited?

Tut. All that we can ſay is conjecture; if they are inhabited, the beings who live there muſt be very different from thoſe we have been converſant with. Some are of opinion they are only intended as a ſupply for that diminution which the ſun muſt ſuffer by the unceaſing emiſſion of its particles of light and heat.

Pup. Do theſe comets prognoſticate evil?

Tut. Many people are frightened at their appearance, as if they portended ſome public national calamity; but without any foundation; for peace, plenty and proſperity have followed their appearance, as well as war, peſtilence or famine. "Be not diſmayed," ſaith the Lord, by his prophet Jeremiah, "at the ſigns of the heavens, for the hea-"then," the ignorant, "are diſmayed at them."

DIALOGUE IV.

ON THE AIR, WIND, RAIN, &c.

Pup. I often hear of the air; what idea am I to form of an element that is inviſible?

Tut. It is a fluid, which agitates bodies when it is in motion. In a word, it has the properties of rarity, tranſparency and elaſticity; and when compreſſed, has an amazing power, ſimilar to the expanſion of gunpowder.

Pup. Has the air any more peculiar properties?

Tut. It conveys ſound, and is neceſſary to give us the ſenſe of hearing; without air, we ſhould have no muſic, no ſmell, no light, nor be able to converſe with each other.

Pup. What is the wind?

Tut. The wind is nothing more than a part of the air, put into motion leſs or more.

Pup. From what cauſe does this ariſe?

Tut. Principally from warmth or cold which is excited in the air. Heat expands the air, and cold condenſes it.

Pup. Have you any particular names, by which to diſtinguiſh the winds?

Tut. According to the quarters from which they blow; Eaſt, Weſt, North, and South.

Pup. Will you pleaſe to tell me how to find theſe quarters?

Tut. If at noon you ſtand with your back to the ſun, the eaſt is on your right hand, the weſt on your left, the north directly before you, and behind you, the ſouth; or at night, if you ſtand with your face to the pole ſtar,—the eaſt is ſtill on your right hand, the weſt on your left, and north and ſouth, as juſt now mentioned.

Pup. Of what uſe are the winds?

Tut. The benefits ariſing from the winds are almoſt innumerable; they purify the air, moderate the heat, dry wet lands and damp houſes, chaſe away the fogs and hazy weather, and bring us the rain in due ſeaſon; alſo, froſt and ſnow, and milder weather. They are particularly ſerviceable for navigation and commerce.

Pup. What are vapours, or clouds?

Tut. Vapours are either thin, inviſible, moiſt particles which float in the air; or, being more condenſed, and by that means rendered viſible, are called clouds. This work of the Creator was obſerved of old. "He bindeth up the waters in his thick clouds, and the cloud is not rent under them."

PUP. From whence do the vapours ariſe?

TUT. They are drawn up by heat out of the earth, and by their lightneſs hang in the air.

PUP. Of what uſe are theſe vapours hanging in the air?

TUT. They cool the air, when it is too hot; they afford us agreeable ſhades, when form'd into clouds; prevent the earth from becoming too dry; and water it with refreſhing rain.

PUP. What is the natural cauſe of rain?

TUT. When the air is ſo full of heavy vapours that it can no longer ſuſtain them, then theſe ſmall moiſt particles, adhering together, fall down in fine drops, which we call rain; which heat, cold, and wind, contribute to produce; and the rain falling in drops is a farther manifeſtation of divine wiſdom; for if it fell in ſtrong ſtreams it would injure the earth, by waſhing away its fine light mould from the roots and ſeeds; and we ſhould ſuffer great inconvenience from it.

PUP. What brings the rain?

TUT. The winds, which convey the clouds over the whole earth.

PUP. What benefit do we derive from the rain?

TUT. It makes the earth fruitful, it refreſhes the withering plants, it cools the air in ſummer, it ſupplies our ſprings, and forms our rivers, ſo that we are never in want of water.

Pup. Are there any ſigns or tokens of approaching rain?

Tut. Many; we can foreſee its approach by the wind, by birds, plants, &c.

Pup. How comes the cold or froſt?

Tut. Generally by the wind, which blows from the continent; and the ſtronger the wind, the ſeverer the froſt.

Pup. How is the ice formed?

Tut. By an extraordinary degree of cold, which congeals the water into a firm ſubſtance.

Pup. Of what uſe is froſt?

Tut. Froſt is of great uſe; it clears the atmoſphere, it braces and ſtrengthens the human frame, mellows the clay ground, and fertilizes it, deſtroys hurtful inſects, and ſerves other uſeful purpoſes.

Pup. What is ſnow; and of what uſe?

Tut. It is nothing but water in another form; white and light, and falls in the moſt beautiful figures; which every perſon may ſee, who will but view the flakes of ſnow attentively. As to its uſe: it preſerves the corn from being chilled by the froſt; therefore, ſaid David, that pious contemplator of nature, "He giveth ſnow like wool;" it hinders the froſt from penetrating too deep into the earth. Snow is alſo a manure to the earth, from the nitrous particles it contains; and, by its colour, diminiſhes the darkneſs of our long winter nights.

Pup. What is hail?

Tut. Nothing more than drops of rain congealed by greater degrees of cold.

Pup. Are not miſts and dews wholly uſeleſs?

Tut. By no means; they refreſh and invigorate weak and withering plants, in time of ſcarcity of rain.

Pup. How do they ariſe?

Tut. They are vapours ariſing from the earth, condenſed by colder air, and thus become viſible.

Pup. What is hoar froſt?

Tut. It is like hail, only vapours congealed, and wiſely ordained for the preſervation of trees and herbs. The hoar froſt is ſcattered like aſhes. This alſo, as well as the ſnow, falls in very beautiful forms, which are well worth minute inſpection.

Pup. What idea am I to form of thunder and lightning?

Tut. Lightning is occaſioned by the electric matter in the clouds, which encountering each other in the air, it explodes inſtantaneouſly like gunpowder, accompanied with that awful roll, or ſound, which we call thunder.

Pup. Is thunder indeed nothing more than ſound; then I need not be afraid of what we call thunder-bolts?

Tut. That is only a vulgar miſtaken idea. All the danger ariſes from lightning—and even that is not dangerous when at a diſtance.

Pup. How am I to judge of its diſtance?

Tut. By the interval between the flaſh and the thunder-clap. If that interval is conſiderable, it is diſtant, and then not dangerous—but when the clap almoſt inſtantly ſucceeds the flaſh, it is then near, and conſequently the greater the danger.

Pup. Have you not told me it is dangerous to go under trees when it lightens?

Tut. Yes, becauſe trees very much attract the lightning. It is better to continue in the open field or public road (if no houſe is near) than to take ſhelter under trees.

Pup. Is lightning of any uſe?

Tut. More ſo than many are aware of. It conſumes noxious vapours—it promotes a circulation of the air—it brings on rain at a time when it is often moſt wanted, and cools the heat of ſummer. " Fire and hail, ſnow and vapour fulfil his word."

Pup. I thank you; I ſhall not be afraid of the lightning, as I uſed to be; but what occaſions the beautiful rainbow?

Tut. The rainbow with its beautiful colours is occaſioned by the rays of the ſun ſhining upon the falling drops.

DIALOGUE V.

ON THE EARTH.

Pup. For what purpoſe was the earth created?

Tut. To be inhabited, and millions of living creatures are in every part of it.

Pup. On what do you ſuppoſe the earth to ſtand?

Tut. It ſtands not upon any thing—if it did, how could it move? Hear the poetical language of Job: "He hangeth the earth upon nothing."

Pup. Does this globe then, which we inhabit, continually hang and move in the air?

Tut. Certainly it does, as well as the other planets.

Pup. What an amazing power muſt it be which fixed them, which firſt ſet them in motion, and which ſtill keeps them there!

Tut. God made the earth by his power—he eſtabliſhed the world by his wiſdom—and ſtretched out the heavens. "On what," ſaith the earth's Creator, "are the foundations thereof faſtened? or who laid the corner-ſtone thereof, when the morning ſtars ſang together, and all the ſons of God ſhouted for joy?"

Pup. Of what are theſe material things chiefly compoſed?

Tut. Of earth, air, fire and water.

Pup. What does the earth conſiſt of?

Tut. It conſiſts of fine mould, ſtone, clay, ſand, minerals, metals, foſſils, &c.—which have each their reſpective well-known uſes. But they are, moſt of them, hid from our ſight, by the green plants and herbs.

Pup. Why is the firmament blue—and the produce of the earth green?

Tut. Becauſe theſe two ſoft, pleaſing colours are agreeable to the eye—and neither weary nor injure the ſight, as ſome other colours do.

Pup. How many ſorts of metals are there?

Tut. Six: gold, ſilver, copper, tin, lead and iron.

Pup. Why are all theſe under the ſurface of the earth?

Tut. If they were above, or upon the ſurface, they would occupy the beſt part of the earth—and prevent our cultivating it. As they now lie in ſubterraneous magazines, they are no hindrance to agriculture.

Pup. Which is the moſt uſeful of theſe metals?

Tut. Iron.—Gold may purchaſe iron—but it will not ſerve as a ſubſtitute for it, becauſe it is not a metal equally hard. Gold would not ſerve for our ploughs or anchors. In a word, not one thing you have about you is made without the aſſiſtance of iron.

Pup. What other valuable things are to be found in the earth's grand magazine?

Tut. That valuable fuel for fire, coals, without which we could neither dreſs our victuals, nor comfortably paſs our winter evenings, and which mechanics alſo find ſo very uſeful.

Pup. When ſuch a vaſt quantity of this fuel is conſumed every day, how great muſt be the ſtore, which our kind Creator has made for our uſe?

TUT. Inconceivable! conſuming every hour, night as well as day—and yet theſe treaſures not exhauſted.

PUP. Is coal equally plentiful in all countries?

TUT. No. If every country produced exactly the ſame things, there would be no commerce, no intercourſe, between diſtant nations.

PUP. Are there any other valuable things to be found in the earth's ſtorehouſe?

TUT. Quick-ſilver, chalk, brimſtone, limeſtone, ſalt, clay for bricks, pipes, and what is uſually called earthen-ware.—Marble, ſtone, chryſtals, diamonds and magnets, or load-ſtones, which are ſo peculiarly ſerviceable to navigation.

PUP. What a rich treaſure the earth contains below its ſurface—and all for the uſe of man!

TUT. Rich indeed! How thankful ought we to be to our bountiful Creator, who has provided ſo many good things, and in ſuch great variety for our uſe and pleaſure.

DIALOGUE VI.

ON MAN.

PUP. Which am I to conſider as the nobleſt work of God?

TUT. Intelligent beings, ſuch as angels and men. I ſhall now ſpeak only of the latter.—Though man is inferior to angels, he is the nobleſt creature on this earth. For God made him the Lord of this lower world—and put all things under his feet. He exceeds other creatures in beauty of form, of limbs, of countenance—in ſpeech, in his erect poſture, and as having a rational ſoul. For God taught man more than the beaſts of the earth, and made him wiſer than the fowls of heaven.

PUP. Will you be ſo kind as to give me ſome information concerning the human body.

TUT. The moſt ſtriking part of the human body is the face, and one peculiar proof of divine wiſdom, is, that every human face ſhould be ſo readily diſtinguiſhed from another, elſe the innocent might ſometimes ſuffer for the guilty.

PUP. This I never before attended to. Pray why is the head formed of a harder ſubſtance than the reſt of the body?

TUT. That ſo tender a part as the brain (the ſeat of reaſon) may be ſecurely preſerved.

PUP. Is the hair of the head merely ornamental?

TUT. No. It not only keeps the head warm, but it ſerves to keep open the pores—to let out the evaporations through their own hollow tubes—and ſerves alſo for its defence from violence.

PUP. Are the hairs hollow?

TUT. Yes, this you may ſee with the microſcope.

PUP. What have you to tell me of the eye?

TUT. It is one of the moſt artfully conſtructed parts of the human body. Leaving the internal conſtruction of the eye to the anatomiſt, I ſhall now only make the following remarks.—That the eye is moveable in its ſocket, that we may be able to ſee on every ſide without moving the head:—That by its poſition it is well ſecured from injury:—That when we have too much light, it has power to contract the apple, or pupil of the eye, to ward off its too numerous rays. And again, when there is but little light, then it can enlarge it to receive more rays.

PUP. Of what ſervice are the eye-laſhes?

TUT. To moderate the ſtrong light, and to preſerve the eye from flying inſects.

PUP. Of what particular ſervice is the eye-lid?

TUT. The eye-lid is as a curtain to be drawn up by day—and to be let down at night when we ſleep, that we may enjoy our reſt with greater ſecurity.

PUP. What is the benefit of the eye-brow?

TUT. It is wiſely formed to keep off the duſt and ſweat, which would give the eye exquiſite pain, beſide being detrimental to the ſight.

PUP. Is not the ear alſo curiouſly formed;

TUT. It is a moſt wonderful conſtruction indeed; but for a knowledge of this too, you muſt wait till you are a little older. It is now ſufficient for you to know that the ear is made of a griſly ſubſtance, to ſtand almoſt ſtiff to catch the ſound, and to conduct it within the auditory tube.

Pup. What is the cauſe of our being able to underſtand one another inſtantaneouſly?

Tut. That we may have an immediate perception of each other's words, God has given to ſound a ſwiftneſs twice as great as that of a ball that iſſues from the mouth of a cannon.

Pup. Aſtoniſhing indeed! but you have not mentioned the ſenſe of ſmelling.

Tut. Our wiſe Creator has placed this ſenſe in a part projecting above the mouth, that we may perceive what is pure and good by its own fragrance; and diſcover what is not ſound and wholeſome before it enters the mouth. The noſtrils, wiſely adapted to this end, are rather broad below to receive the ſmell. Through theſe alſo paſs the ſharp humours of the head—and when during the time of our eating, we cannot breathe with the mouth, we can breathe through the noſtrils.

Pup. What is there obſervable concerning the taſte, and the ſenſe of feeling?

Tut. The taſte enables us to judge of good or bad food, and affords us much pleaſure. The ſenſe of feeling is ſpread over the whole body, whereas the other ſenſes have their reſidence in the head.

Pup. Where are theſe ſenſes the ſtrongeſt?

Tut. Where they are moſt wanted. For inſtance, the taſte on the tip of the tongue, and the lips—the feeling at the ends of the fingers, and in ſome other parts. Our ſenſes are ſet as faithful guardians for our preſervation; and when we loſe one ſenſe, we often find that another grows the ſtronger: as in blind people, it is obſerved that the hearing becomes more acute.

Pup. What merits our farther attention in the head?

Tut. The tongue, that wonderful inſtrument of ſpeech, from which ariſes ſo great a part of our earthly happineſs. It is alſo well adapted to aſſiſt the chewing of our food, to mix it with the ſaliva, ſo neceſſary for digeſtion—and to help it in the paſſage to the throat—And without the tongue we could have no vocal muſic.

Pup. The uſe of the teeth I need not aſk you; but what prevents them from wearing away by ſuch inceſſant labour?

Tut. A fine enamel with which they are covered. For when this wears off, the teeth decay, and hence ariſes the common complaint the toothache. But, beſide their uſe in chewing—you may not perhaps have obſerved that they contribute to the formation of our ſpeech: for they who loſe many of their teeth are not ſo eaſily underſtood. The lips alſo ſerve for the ſame purpoſe—hence ſome of our letters are called labials. Beſide this, with the lips we receive and taſte our food.—But ſuppoſe we here pauſe a little, leſt I weary your young mind.

Pup. I am not weary, but I ſubmit to your pleaſure.

DIALOGUE VII.

ON THE HUMAN BODY.

Tut. We now proceed to the throat.—In this is an open tube, which we call the wind-pipe, thro' which we breathe. Behind this is another called the gullet, through which the food paſſes into the ſtomach.

Pup. Muſt not then our food paſs over the open wind-pipe, and conſequently be in danger of falling in?

Tut. So you might well think. But proviſion has been made againſt this. Behind the root of the tongue we find a muſcular membrane * which cloſes the wind-pipe whenever we attempt to ſwallow any thing, over which the food paſſes, as if it went acroſs a bridge.

Pup. A crum of bread gives us pain in the throat ſometimes; from whence does that ariſe?

Tut. From its falling into the windpipe (or as we commonly ſay, going the wrong way); but this does not happen often, unleſs we laugh or talk while we have our mouth full of food. Great wiſdom is alſo diſcernible in the ſtructure of the neck. It is formed with ſo many joints, that we can eaſily turn the head without moving the whole body: and is provided with ſtiff bones to keep the head upright without which man would loſe much of his grace and dignity.

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* Called the epiglottis.

We now deſcend from the head and neck to the body. The larger bones may be conſidered as the great pillars of a building:—The muſcles, or the fleſhy parts, as ſo many cords to bring every thing into motion:—The arteries and veins as the ſtreams of refreſhment and the ſprings of life.

The heart, in the middle, as the fountain or working machine, conveys the blood by means of the arteries to the extremities, which is returned back by the veins; and the continual pulſation of the heart keeps up the perpetual circulation of the blood. The lungs are inſtruments to admit good air to cool and refreſh the blood—and to let the air out when it has performed its office. The ſtomach is a great laboratory, where every thing is prepared that can ſerve to the neceſſary recruiting of the whole body. The arms, hands and fingers, may be conſidered as the guardians of the body, the houſe, and alſo to labour in the various duties of life; the fingers are therefore formed with ſmall bones and ſtrong muſcles, to move with the greater eaſe.

PUP. Is not the right hand formed with more or ſtronger muſcles than the left?

TUT. That we can do more with the right hand is only owing to habit—becauſe we have been accuſtomed from our infancy to uſe that more than the left.

Pup. Have you any thing more particular to obſerve here?

Tut. It is worth attention to remark, that the ſkin of the hand becomes thicker, that it may not be worn out by working, and yet does not entirely loſe its feeling. The ſame may be obſerved of the ſoles of the feet. The poſition of the thumb alſo gives additional ſtrength to the fingers, by enabling them to keep firmer hold of any thing. And farther, you may alſo conſider—what works of art, ſuch as writing, drawing, painting, and inſtrumental muſic, are performed by theſe five ſmall members of the human body. And to crown and perfect the human fabric, the whole body is covered with a fine ſkin, as a curiouſly-wrought upper garment without a ſeam; through which are an infinite number of inviſible ſpiracles or apertures, which we call pores.

Pup. Of what particular uſe are theſe pores?

Tut. Through theſe evaporate the ſuperfluous moiſture of the body, which we uſually term perſpiration; the regularity of which is ſo neceſſary for the health of the body, that when perſpiration is ſtopped, it throws the body into uncommon heat, which we term a fever, and which is ſo often fatal. Exerciſe and cleanlineſs are the beſt promoters of this neceſſary perſpiration.

DIALOGUE VIII.

OF THE INTERNAL PART OF THE HUMAN BODY.

Pup. I ſhould now be glad if you would give me a clear idea of thoſe parts of the body which are not viſible to the eye; I mean its internal parts.

Tut. The principal internal parts are, firſt, the ſtomach, a wide paunch in which the food (that has been chewed in the mouth) is diſſolved. To facilitate the diſſolution of which, it receives in its progreſs a liquor from the gall bladder. The next things obſerveable are, the bowels, which receive the food from the ſtomach, puſh forward the ſofter parts, and abſorb all the fine juices, by means of numerous abſorbent veſſels called lacteals, which are placed in the bowels, and are of curious conſtruction. The bowels are near th[illegible]y feet long, but by their various foldings take up but a ſmall compaſs.

Pup. What becomes of the groſſer parts of our food?

Tut. When all the nouriſhment is drawn from it, thoſe groſſer parts paſs onward to be diſcharged from the body.

Pup. And how or in what manner is the body nouriſhed by food?

Tut. The fine juices (called chyle) are conveyed by means of the thoracicduct, to the heart, to be formed into blood.

Pup. How is all this work effected?

Tut. The heart receives theſe juices, and injects them into the lungs, and the lungs preſs and prepare them. The air, drawn in by the lungs, paſſing through the windpipe, carries off the inflammable parts in the act of breathing, and the lungs return the juices back to the heart, and they are thus converted into good blood, which nouriſhes the whole body.

Pup. What gives the blood its motion or circulation?

Tut. In that lies the grand ſecret, termed life.—The heart has a power of opening and of cloſing its cavities, which we call its expanſion or contraction.—And as long as this continues we live. By the former the blood is brought in, and by the latter ſent forcibly out into a duct, called the great artery. It is ſuppoſed the pulſations of the heart are more than two thouſand every hour, whether we wake or ſleep.

Pup. I am loſt in wonder and admiration!

Tut. Adopt the words of the pſalmiſt, who was much employed in meditating on the works of God, "I will praiſe thee, for I am fearfully and "wonderfully made. Marvellous are thy works, "and that my ſoul knoweth right well."

But I have one thing more to call your attention to, which will alſo excite your aſtoniſhment. It is this, if the blood (which is brought again to the heart, into its other cavity, from the extremities of the feet through the veins), was ever to flow back, we ſhould die; but this is prevented by ſmall ſluices or valves, placed in the veins, which permit the blood to paſs forward, but effectually prevents its return.

Pup. David might indeed well ſay, that we are fearfully and wonderfully made.

DIALOGUE IX.

OF THE HUMAN SOUL.

Tut. Having ſpoken ſo largely of the body, I ſhall now proceed to give you ſome account of the ſoul. This is far ſuperior in excellence and dignity to the body on account of its ſpiritual nature, its intellectual and moral powers—and its immortal duration.

Pup. What are thoſe powers?

Tut. They conſiſt in forming ideas, thinking, reaſoning, judging and willing. And it poſſeſſes, beſides, the powers of memory and imagination.

Pup. Has the ſoul any paſſions?

Tut. Yes, ſuch as joy, love, deſire, hope.—And a ſenſe of honour. It feels pity and compaſſion. It has alſo the paſſions of fear, ſhame, grief, anger, &c.

Pup. Are theſe paſſions beneficial to us?

Tut. Without doubt, when under proper regulation. They were deſigned to excite us to moral and pious actions. But if theſe paſſions are not under proper diſcipline, they may lead us to much evil, and expoſe us to great injury. "He that hath no "rule over his own ſpirit is like a city broken down, "and without walls."

Pup. Is it known how the ſoul is united to the body?

Tut. That ſurpaſſes the conception of the wiſeſt philoſophers.

Pup. But muſt not man die, though ſuch a noble creature? What a pity that ſo beautiful a fabrick ſhould crumble to duſt!

Tut. Every day's experience proves our mortality, but the goſpel gives us the ſtrongeſt aſſurance that good men will be raiſed again with more perfect bodies, and placed in a ſtate of happineſs that will never end.

are dying perpetually, is there not ſome danger of the world's loſing all its inhabitants?

Tut. Though from calculations which have been made, ſixty are ſuppoſed to die every minute, yet more than ſixty are ſuppoſed alſo to be born every minute. And for every hundred females born into the world, there are alſo born one hundred and five males, as more of the latter are ſuppoſed to die in early years than the former, and many by wars.

Pup. Do more men die in the country than in very populous cities?

Tut. More in cities; becauſe there the air has not that free circulation it has in the open country, conſequently it is not ſo pure for breathing; beſides, infectious diſorders more eaſily ſpread their baneful influence, and are more readily communicated, when habitations are ſo contiguous to each other, and the ſtreets and lanes are very narrow, and crowded with inhabitants. But wherever we live, whether in town or country, we breathe God's air, we enjoy his light, we live upon the produce of his earth—in ſhort, all that we have is the Lord's. It muſt therefore be manifeſtly our duty to ſerve him, both with our bodies and our ſpirits which proceed from him.

DIALOGUE X.

ON LAND AND WATER.

Pup. Would not the earth be more beautiful, if it was one ſmooth extended plain, without hills and mountains—Do not the mountains disfigure it?

Tut. By no means. Do you think the duſt that falls upon the Geographical Globes disfigures them? The mountains are no greater in compariſon with the whole earth, than the duſt to the globes; or the roughneſs of an orange. Without mountains we ſhould have no ſprings nor rivers; they receive the vapours, the rain and the ſnow, which ſupply the ſprings with water. Mountains are the grand magazines of metals, minerals, marble, ſtone, &c.

and beſide attracting the clouds, they ſhelter the low-lands and vallies from the bleak and cold winds.

PUP. What is the uſe of thoſe ſand-hills which are ſo numerous upon the coaſt of Holland, and upon which nothing grows?

TUT. They ſerve to hinder the boiſterous waves of the ſea from over-flowing the Low Countries.—This is worthy your reflection, that ſmall grains of ſand, which you can blow away with your breath, when thrown into a maſs, form ſuch a ſtrong barrier againſt the raging ocean. "Will ye not tremble, "ſaith the Lord, at my preſence, who have placed "the ſand for the bound of the ſea, by a perpetual "decree that it cannot paſs it—and though the waves "thereof toſs themſelves, yet can they not prevail—"though they roar, yet cannot they paſs over it."

PUP. I ſhould wiſh now, if you pleaſe, to turn my thoughts from the land to that great body of water, the ſea. What is there worthy my obſervation?

TUT Its extent—its depth—its ſaltneſs—its ebb and flood—and its limits or boundary.

PUP. How large is the ſea?

TUT. It takes up two thirds of the whole earth.

PUP. Why is it ſo extenſive?

TUT. For wiſe purpoſes no doubt. Some philoſophers think it may ſerve as a balance to the land. It is a grand reſervoir of water, from which millions of tons are raiſed up by the warmth of the ſun, to form clouds and rain, to ſupply the whole earth with water.

PUP. There ſeems then a continual circulation in the material world, as there is in the animal body.

TUT. You judge right. The rain forms the ſprings, the ſprings form the rivers—the rivers run into the ſea. The ſea furniſhes the riſing vapours, the vapours form the clouds, and the clouds give the rain. This reciprocal ſucceſſion began with the creation, and will continue to the end of the world.

PUP. What am I to underſtand by the ebb and flood of the ſea, or the riſing and falling of the tide, as it is commonly called?

TUT. That this amazing collection of waters riſes every ſix hours, more or leſs, which is called flood—and after a very ſhort time of reſt falls again, which we call the ebb.

PUP. What is the cauſe of this regular movement of the waters, and what is its uſe?

TUT. The ebbing and flowing of the ſea are ſuppoſed to be occaſioned by the motion of the earth, and the attraction of the ſun and moon, which you will be better able to comprehend when you grow older—this movement of the water preſerves it from corruption, which would take place if it was in a ſtate of reſt and ſtagnation. The tides are alſo exceedingly uſeful to navigation and commerce.

PUP. Is not the depth of the ſea very great?

TUT. It is not of equal depth—in ſome places navigators can find no ground with a line of more than ſeven hundred and eighty fathom.

Pup. Why is the ſea ſo deep?

Tut. God, who meted out the heavens with a ſpan, alſo meaſured the water in the hollow of his hand—he adjuſted it in wiſe proportion no doubt to the land—and for this reaſon it may be ſo large and deep. By its depth it contains much more water, and there remains ſo much more dry land.

Pup. Why is it ſo ſalt?

Tut. To preſerve it pure, and to yield us ſo valuable an article of life.

Pup. Does the ſea then produce ſalt?

Tut. A great quantity of ſalt is taken out of holes dug on the ſea-ſhore, from whence ſea-water is exhaled by the ſun, leaving behind the ſalt which it contained.

Pup. How beneficial is the ſea for man!

Tut. But ſurely you have not forgotten the great benefit man receives from that vaſt inexhauſtible ſtore of fiſh which it contains, great and ſmall, from the whale even to the ſhrimp—for even thoſe which are not good for food, are uſeful for the wants and conveniences of life. Neither, ſurely, have you forgotten the extenſive general benefits of commercial intercourſe, carried on upon its ſurface, between the moſt diſtant nations of the earth—the ſupport which it is the means of affording to ſhip-builders—and for ſo uſeful a body of the community as ſailors.

PUP. What confines and keeps the ſea within its proper bounds?

TUT. The Divine Ordination. The ſame all-creating Word which ſaid, "Let there be light, "and there was light:" ſaid alſo to the raging ſea, "Hitherto ſhall thou come, but no farther, and "here ſhall thy proud waves be ſtaid."

PUP. What an immenſe quantity of vapour muſt be raiſed out of the ſea to ſupply the ſprings which form ſo many great rivers in every quarter of the world! But how is water raiſed into the air, which I have heard you ſay is much heavier?

TUT. This merits your attention. Though water is, as you remember I told you, heavier than air, yet it is capable of being made lighter than air, and then it will aſcend. The water which you ſee daily on the kitchen fire would all evaporate in ſteam when boiling; this familiar occurrence may ſerve to give you ſome idea how water may be made to aſcend in the air. Our philoſophers tell us that a particle of water may be ſo rarified, that it may become ten times as large as it was before; and this you may have ſeen yourſelf without having obſerved it in this light, in the bubbles which children form with a pipe, which immediately aſcend, being then become lighter than air.

PUP. But what is the principal cauſe of the aſcenſion of theſe vapours from the ſea?

Tut. The warmth and heat of the ſun, by which the water is rarified—that fire is lighter than air, you may ſee from the velocity with which all flames aſcend into the air.

Pup. What is your opinion of fire?

Tut. It is as neceſſary and uſeful as air and water.

Pup. Where do you acquire it?

Tut. It lies hid almoſt in every thing, becauſe we have continual need of it—there it remains in a ſtate of reſt—but when it is brought out of its reſting place, it ſpreads itſelf amongſt fuel, whether of wood or coals. It melts and ſoftens the hardeſt metals, evaporates moiſture, boils and roaſts our meat, and warms our houſes in the cold months of winter. Without fire, having no candles, lamps or torches, we ſhould be without light too, as well as without warmth and heat.

DIALOGUE XI.

OF ANIMALS.

Pup. I ſhould now wiſh to know ſomething of the animal creation?

Tut. There are ſeveral hundred thouſand ſorts of living creatures. Some live in the water, ſome on the earth, and ſome in both, which laſt we call amphibious; and others are inhabitants of the air—but all are ſubject to the reaſon of man.

PUP. Why are they?

TUT. That they may be made uſeful to us; which otherwiſe they could not be, becauſe of their ſuperior ſtrength.

PUP. Have animals ſenſes as we have?

TUT. The four-footed beaſts have five, and ſome of them ſtronger than ours; the ſmell in hounds, for inſtance, and hearing in moles.

PUP. How are ſo many millions of creatures ſupported and preſerved?

TUT. Every day a table is (as it were) provided by God's providence for ſo many gueſts. Care is alſo taken that we cannot annihilate any one ſpecies of food which God has created.

PUP. Is there any thing farther to be obſerved?

TUT. Each have their weapons of defence; and they know, when they are ſick, what will relieve them. They know the element in which they are to live, and their own proper food; they know how to build their habitations, (of this kind the beavers ſeem to approach the neareſt to human ſagacity) they are able to diſtinguiſh their enemies, and to underſtand each other.

PUP. If they underſtand each other, have they then a language peculiar to themſelves?

TUT. They have: this appears from the different ſounds lions, bears, wolves, horſes, &c. make in different ſituations.

PUP. Have they paſſions like ours?

Tut. Yes, they have affection, joy, grief, ſympathy; they have manifeſtly anger and reſentment, jealouſy, &c. It may here alſo be obſerved that the nature or diſpoſition of each remains the ſame; the horſe is ſpirited and full of fire, the lamb mild and gentle, the hare timid, and the dog watchful and faithful to his maſter.

Pup. Oh how much are we indebted to our kind Creator, who has made all theſe ſubſervient to us!

Tut. And our thankfulneſs ſhould riſe ſtill higher when we reflect that theſe living creatures are not only deſigned for our uſe, but for our food alſo, at leaſt the greateſt part of them. This conſideration ſhould induce us to treat the brute ſpecies with lenity—cruelty to them is ingratitude to God who formed them. On the contrary, we ought to take all proper care of them, and give them whatever is neceſſary for their ſupport; and never injure them, by too ſevere labour and fatigue. "Thou ſhalt "not muzzle the ox when he treadeth out the corn." And again, "A righteous man regardeth the life of "his beaſt."

Pup. But of what uſe are the wild beaſts of the foreſt?

Tut. They are all ſerviceable in ſome degree; ſome for food, others for clothing. The ravenous beaſts of prey may prevent the too great increaſe of other noxious animals; the wild beaſts of the foreſt may alſo prevent man from retiring into deſerts, and baniſhing himſelf from ſociety and from uſefulneſs.

neſs. They ſerve alſo to ſhew us the greatneſs and variety of God's works, and the fine gradation there is from the ſmalleſt of the animal tribe, up to the lion, the elephant, and the rhinoceros; and to ſhew us that providence extends its care even to the inhabitants of the wilderneſs. "Thou makeſt dark-
" neſs, and it is night, wherein all the beaſts of the
" foreſt do creep forth. The young lions roar after
" their prey, and ſeek their meat from God."

DIALOGUE XII.

OF BIRDS.

Pup. Will you now be ſo kind as to ſpeak of the feathered tribe? I am delighted with the ſweet notes of birds.

Tut. To enjoy this pleaſure undiſturbed, you muſt riſe early in the ſummer ſeaſon.

Pup. I have been taught by my parents to riſe early to preſerve my health; and I find it contribute both to my health and pleaſure.

Tut. I hope then you will always riſe with the lark: an early hour is the beſt alſo for reading, for meditation, and ſtudy. But to return to our ſubject. The production and the ſtructure or formation of a bird call firſt for your attention.—Obſerve how it acquires its exiſtence, out of that matter or ſubſtance with which an egg is filled; and this effected after it has been impregnated only by a brooding heat. The ſtructure of birds is alſo curious, and a proof of great ſkill and wiſdom. How well adapted is their form for flying! The ſubſtance of their bones is much thinner than that of land animals, that they may be lighter and better able to mount in the air. And that the thinneſs of the bones ſhould not render them weaker, the ſubſtance of the bone itſelf is ſtronger and harder.

With their pointed beak they can more eaſily cut the air: but what is moſt obſervable in birds, is their being capable of flying in the air; and ſome of them with amazing rapidity, for which purpoſe their wings are curiouſly conſtructed. But the flight of birds is what we ſee almoſt every hour, and therefore, like moſt other things that are common, eſcapes our notice.

PUP. Our motion upon the earth from one place to another, with ſo much eaſe, and this too almoſt without our thinking of it, might well excite our admiration at the wiſdom of our Creator: but the motion of birds in the air is ſtill more ſurprizing: and I long to know ſomething farther of the ſtructure of their wings, and in what manner they move and ſuſpend themſelves in the air.

TUT. I am glad to find in you an increaſing deſire of knowledge; but this with many other things which we have only juſt touch'd upon, you will better be able to comprehend a few years hence.

PUP. I thank you, but will you tell me more now?

Tut. You were juſt obſerving that you are much pleaſed with the ſinging of birds: and does it not ſtrike you with admiration too, that the tender throats of ſuch ſmall creatures, and thoſe of the male particularly, ſhould be able to form ſuch ſhrill and variegated notes, while a great ox, or bull, can only bellow and roar. It is obſervable farther, that as they have to fly through the woods, they are provided with a membrane to protect the eye, which we have not—And alſo, that their ears are placed more within, and covered with feathers to guard them againſt the preſſing wind.

Pup. I do not perceive, that birds have any teeth to chew their food.

Tut. True. But to break their food ſmall, they have beaks, as tough as horn, which are very long in thoſe that fiſh under water, ſhorter in thoſe that muſt peel ſeeds, and hard as iron in thoſe of a ſtronger contexture.

Pup. Do not they ſometimes periſh for want of food?

Tut. I believe not for want of food, unleſs in ſome extraordinary caſes. "They ſow not," ſaith our Lord to his diſciples, "neither do they reap, nor "gather into barns; yet your heavenly Father feed-"eth them." And what is worthy your notice here, is, that thoſe birds which lay not up any ſtore for winter, are always reaſonably provided for; not even the ſparrows are forgotten before God. "He "giveth to the beaſt his food, and to the young

" ravens which cry." Thoſe birds which find not their proper food in one country fly to another: Theſe we call birds of paſſage—ſuch as the ſtork, the crane, the ſwallow, the woodcock, the turtle, and ſome others, which leave their own country at ſtated periods, to go to more favourable climates, and return again on the change of the ſeaſon.

Pup. That is truly amazing. How can they find their way over different kingdoms and ſeas?

Tut. They have that knowledge which we call inſtinct. " The ſtork in the heaven knoweth her " appointed time; and the turtle, and the crane, and " the ſwallow obſerve the time of their coming."

DIALOGUE XIII.

OF FISHES.

Tut. To what ſhall we next turn our attention? Suppoſe we now take a view of the inhabitants of the watery world. What think you of creatures living in an element which would be fatal to us, and which could not live upon the earth as we do? water is the dwelling place of millions of fiſhes.

Pup. How diverſified are the divine works!

Tut. So exclaims the pſalmiſt, " O Lord, how " manifold are thy works, in wiſdom haſt thou made " them all. The earth is full of thy riches. So is " the great and wide ſea, in which are things " creeping innumerable."

The ſtructure of fiſhes is entirely oppoſite to what is proper for the flying of birds. Different means muſt neceſſarily be applied to make birds and fiſhes move upwards and downwards in their different elements. A ſmooth long body, thick before, and gradually diminiſhing in bulk behind, is the beſt formed for ſwimming. And of this form are fiſhes.

Pup. How do they breathe?

Tut. Not as we do. For the air comes in through the mouth, and goes out through the gills.

Pup. Have they ſenſes?

Tut. The noſtrils ſhew they have the uſe of ſmelling. Their feeling too is finer than ours, becauſe they ſooner perceive the changes of the weather. Neither is their ſenſe of ſight prevented by the water, for which purpoſe their eyes are differently conſtructed from ours.

Pup. Of what uſe are the ſcales of fiſhes?

Tut. To preſerve them from being bruiſed, or cruſhed by the preſſure of the water—and to guard them againſt the cold.

Pup. How do they dart forward ſo nimbly in the water?

Tut. By means of their tail, by the motion of which they puſh themſelves forward.

Pup. Of what uſe are the fins?

Tut. To keep them in equilibrium, or with their belly downward—to turn on either ſide, or to ſtop their progreſs.

Pup. By what means do they riſe or deſcend in the water?

Tut. They are enabled to do this by a white air-bladder, which they can dilate or contract at pleaſure.

Pup. How does that occaſion their aſcent or deſcent?

Tut. Becauſe, in the firſt caſe, they are lighter than water—and in the latter, heavier.

Pup. How are they ſupported?

Tut. They eat worms, and flies, and plants. And the large fiſh feed upon the ſmaller, of which our bountiful Creator has given ſuch a vaſt increaſe, that the ſpawn of a perch, would produce more than twenty-eight thouſand. "And God ſaid, let the "waters bring forth abundantly."

Pup. Are there any fiſh which migrate in the water, as birds of paſſage do in the air at certain ſeaſons.

Tut. Yes, Such as the ſturgeon, ſalmon, herring, ſmelt, pilchards, and others; ſome of which come from the ſea into our rivers, and others are found in ſhoals, in certain parts of the ocean—and, at certain times of the year. To which they are, no doubt, led by what we uſually term inſtinct.

Pup. What a vaſt ſtore of proviſion is here laid up for man!

Tut. Thus you ſee how good and bountiful God is to us.—"He has put all things under our "feet. All ſheep and oxen; yea, and the beaſts of

"the field, the fowl of the air, and the fiſh of the
"ſea, and whatſoever paſſeth through the paths of
"the ſea. O Lord! our Lord! how excellent is
"thy name in all the earth!"

DIALOGUE XIV.

OF INSECTS.

Tut. Let us now take a view of the ſmaller part of the living creation. What think you of thoſe called inſects?

Pup. I cannot ſay I ever thought much about them.

Tut. But we ſhould not overlook any part of God's creation.

Pup. Where do inſects live?

Tut. Every where. In the air, the earth, the water, in wood, in ſtone, in ſhells, in mud, and in ſand.

Pup. On what do they live?

Tut. Upon almoſt every thing—upon fleſh, fiſh, flowers, herbs, filth, and dirty ſlime, which is often ſeen upon the water in ſummer.

Pup. What parts of an inſect are moſt to be admired?

Tut. Their fine beautiful eyes, their wings, their colour, their offenſive and defenſive weapons, &c. If you look through a microſcope, you will find, that what we thought to be duſt on the wings of a butterfly conſiſts of a number of beautiful feathers, arranged in great order.—The legs alſo of inſects are worthy of peculiar attention. Thoſe of a fly, for inſtance, by which it can walk up a window perpendicularly, or horizontally upon a cieling.

PUP. How can they do that?

TUT. By means of a glutinous matter, which enables them to keep their hold. But beſides this, many bodies which appear plain and ſmooth to the naked eye, have a roughneſs, which their ſmall and tender feet can catch hold of.

PUP. How are they propagated?

TUT. By eggs, which they carefully hide in the moſt ſecure places in great quantities.

PUP. Are not many inſects injurious?

TUT. Some no doubt are. The locuſt, caterpillar, and ſome others. But that theſe may not be too numerous, great multitudes of them are deſtroyed by birds.—But even caterpillars, which we deem ſo pernicious, are yet very ſerviceable.—And I doubt not, but many other inſects are uſeful for purpoſes which we are ignorant of.—The ſeveral members of this little tribe are (with ſome few exceptions) very induſtrious. From the labour of bees, we receive our honey and our wax. The former being lodged in warm apartments of their own forming.

PUP. And how can thoſe creatures do what man cannot do? how can they make honey?

TUT. By flying abroad, and collecting together the very fine eſſence of flowers, both of the field and of the garden, which is done by their trunk, with which ſmall tube they ſuck up the delicious ſyrup as nature produces it, and then depoſit it in cells.

PUP. Do they each know their own cell, and keep to that as their conſtant place of reſidence?

TUT. Bees are like a well-ordered community. They have a ſovereign bee, to whom they are all under ſubjection. The laws and regulations of this induſtrious tribe are generally ſubmitted to, and punctually obſerved. They all labour for the common good, and mutually aſſiſt each other. In ſhort, man himſelf may from them receive much inſtruction.—Their haſtening to their hives in great numbers is a ſure ſign of rain.

PUP. Is it not cruel to put to death a whole community? and unjuſt to ſeize the fruits of their labour?

TUT. There is no injuſtice in appropriating the fruits of their labour to our uſe, becauſe by their making more honey than they want, we perceive that a part was deſigned for us. And with reſpect to putting them to death; why may we not as well put theſe to death, as an ox, or a ſheep? It is the number of the ſlain in one and the ſame moment, all periſhing together, that alarms our feelings; could we ſee as many cattle ſlaughtered in the field in one day, we ſhould exclaim againſt it as an act of cruelty---but as theſe are killed at ſeparate times, and in different places, it is in that proportion leſs ſenſibly felt.—However, there is a method of taking the honey, without deſtroying the bees; and this is certainly the beſt.

Pup. But how can they ſubſiſt during the winter, if we deprive them of their honey?

Tut. We always leave them what is ſufficient, or ſupply them as they are in want. So that what we take may be conſidered as a kind of ſuperfluity which they can well ſpare.

Pup. Are not ants, too, remarkable for their induſtry, regularity and order?

Tut. They are a little people united like the bees; but may rather be termed a commonwealth, than a monarchy. Their ſagacity is very conſpicuous in the various methods they uſe to procure food, and their friendly contrivance to carry it home. The food they ſtore up ſo carefully, is probably for their young, when they firſt come out of the egg, for in the winter they are ſuppoſed to be in a torpid ſtate.

Pup. I have heard, I t[illegible]k, ſomething remarkable concerning caterpillars.

Tut. Beſides their beautiful form, in their firſt ſtate, after ſome time they change their coat, and become beautiful butterflies.

Pup. But do not they produce our ſilk?

TUT. Without doubt: they are ſilk manufacturers.—This they make of a gum, which they have in their inſide in a ſmall bag or bladder. In goldſmiths ſhops you may probably have ſeen iron plates with holes, through which they draw the gold wire to its proper ſize. The ſilk worm, has under her mouth, ſomething reſembling ſuch a kind of perforated inſtrument, through which ſhe draws the gum. This ſupplies the materials, out of which ſhe ſpins her thread, and by paſſing through thoſe holes it receives its form and length.

PUP. How uſeful are theſe inſects, which we are apt to deſpiſe!

TUT. More uſeful in their humble ſphere, than ſome of the human ſpecies themſelves. All uſeleſs members of ſociety may learn a leſſon even from the tribe of inſects.

PUP. Are ſpiders of any uſe?

TUT. Our averſion to ſpiders, ariſes from their ejecting a poiſonous matter, with which they kill their enemies. But I believe the quantity they can eject, though fatal to inſects, would not produce to us any great injury. Spiders, however diſagreeable to us, are not without their uſe:—They catch and deſtroy many flies:—The webs which they ſpread over the trees in ſummer, in ſome degree preſerve the fruit. And they may be more uſeful in our houſes than we are aware of. They may inhale ſome noxious qualities of the air, which might otherwiſe become prejudicial to us. The webs which ſpiders form, particularly in gardens, are exceedingly curious.

PUP. How do the field ſpiders carry their firſt thread from tree to tree, or, acroſs the lanes, as we often ſee in the ſummer?

TUT. Some have thought, that the ſpider muſt fly, to do this: but ſhe tranſports herſelf in this manner *.

" She places herſelf upon the end of a branch, or,
" ſome other projecting body, and there faſtens her
" thread: after which, ſhe preſſes out more long
" threads which ſhe leaves floating in the air; theſe
" threads are wafted by the wind, from one ſide to
" another, and are there faſtened by their natural
" glew; ſhe afterwards draws them to her, to try if
" they are well fixed, and then they become a bridge,
" over which the ſpider paſſes and repaſſes at plea-
" ſure."

Others are of opinion, that as theſe are often ſeen, when there is no wind to waft them over, that after having fix'd the thread on one ſide, dropping then to the ground, they carry the thread themſelves; and mounting where they want to fix it—there draw and faſten it.

PUP. I have often wondered, how ſnails build their habitations, which they carry about with them.

TUT.

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* Nature diſplay'd.

TUT. Their carrying their own habitations with them, is ſomewhat ſingular: I am not ſurpriſed that your inquiſitive eye ſhould have noticed it.

Every animal in nature, has its habitation. The roof under which the ſnail reſides, has two properties, which appear difficult to be united, ſolidity and lightneſs: without which its inhabitant could neither be protected from injury, nor transfer its habitation from place to place.—At the approach of winter, ſhe retires into ſome cavity—and her body diſtills a certain glutinous matter, which cloſes up the aperture of the ſhell. Thus ſhrouded up, ſhe paſſes the cold ſeaſon in ſafety. When the ſpring ſeaſon commences, ſhe opens her door—and ranges at her pleaſure.

PUP. I think I remember to have heard ſomething remarkable concerning the eyes of ſnails.

TUT. Probably you may, for they are uncommonly curious and ſingular. As they creep upon the ground, and have the weight of their apartment upon them, if their eyes were not ſomewhat elevated, they could not well diſtinguiſh what they were to avoid, or what they might approach. To prevent this inconvenience, they are furniſh'd with what we may term teleſcopic eyes. Thoſe which children call the ſnail's horns, are four tubes, with a glaſs at the extremity of each; or, if you will, you may call them four optic nerves, which end in as many beautiful eyes. Theſe ſhe can elevate, and turn about in every direction, and lengthen or contract them, as we do the teleſcope.

Pup. I do not perceive that they have any feet.

Tut. To ſhew the diverſity of the divine works, they have two large muſcular ſkins, which they can lengthen and contract at pleaſure, by which means they move and draw their caſtle, which reſts upon their backs.—And to prevent accidents, they are provided with a viſcous humour, which by its coheſion, ſecures them from falling, and renders them impenetrable to moiſture, by an oily matter with which they cloſe all the pores of their ſkin.

Pup. And now pleaſe to inform me how their ſhell is made?

Tut. The ſnail has a very ſmall ſhell, rather ſoft when ſhe leaves the egg: this ſhell forms the baſis of a ſecond, which is gradually increaſing. The firſt is the centre of the other, and the whole is formed by adding new circles to the firſt ſhell. And as her body can only be extended towards the aperture, this muſt conſequently be the part which receives the freſh acceſſions. The materials from which the ſhell is made, are lodged in the body of the animal, and formed by a viſcous fluid, and ſandy particles of exquiſite fineneſs, which thicken into a conſiſtence round the extremity of the ſhell, and become incruſtated. This will alſo give you ſome idea how the ſhells of all ſorts of fiſhes are formed.

Pup. I thank you for the trouble you take with me, in giving me theſe inſtructions, which ſo much enlarge my ideas of the wiſdom, power and goodneſs of the Creator.

DIALOGUE XV.

OF PLANTS, AND THEIR PROPERTIES.

TUT. Our indulgent Creator, who formed this earth, for us to live upon, formed it alſo to produce what is neceſſary for our ſupport and pleaſure. Such as plants, trees and flowers, in very great variety. From the beginning of the world, theſe have continued in regular ſucceſſion, without any new creation in any one production of the earth, unto the preſent day. Neither in living creatures is there any new creation. Men, beaſts, birds, fiſhes, inſects, none of them are loſt.—And what merits your particular notice, is, that ſo many thouſands of plants, growing in the ſame ſoil, and enjoying the ſame ſun, and the ſame rain, ſhould differ ſo much in taſte and ſmell from each other.

PUP. From what are plants produced?

TUT. From ſeed, produced by the plants, each producing its kind, which lie neatly encloſed in huſks, for their preſervation. And of theſe there are above twenty thouſand different kinds. Seeds ſhoot their root downward, and the ſtalk or trunk, upward.

PUP. And how do they grow?

TUT. By the air, rain, warmth and nouriſhment

which

which they imbibe from the moiſture of the ground, in the ſmall fibres of their roots.

PUP. Of what uſe is the bark, and the leaves of trees?

TUT. The bark to preſerve them from external violence—and to nouriſh them by the riſing of the ſap—The leaves, to catch and receive the dew and rain.

PUP. I think you told me once that there are not two leaves alike, even on one tree.

TUT. True, two things exactly alike, are not to be found in the whole world: So various are the works of God. The uppermoſt ſurface of the leaves is ſmooth or varniſhed, that the water may not lodge upon them, which would ſoon make them decay. The undermoſt is without that varniſh, that it may imbibe the dew.

PUP. Of what uſe are thoſe trees, which bear no fruit?

TUT. Our foreſts not only afford us a beautiful variegated proſpect, and an agreeable ſhade—but alſo timber for building—maſts for our ſhips—materials for huſbandry—for furniture—and for the various exerciſes of art—and for fuel.—Of theſe, the oak, the aſh, the fir, the ſycamore, the beech, the elder, the walnut, the elm, the willow, the box, the mahogany and the cedar, are the moſt valuable.

PUP. I was not before ſo ſenſible of the value of trees in general; thoſe which I valued moſt, were fruit-trees.

TUT. And even of theſe, how plentifully has our heavenly Father provided—and in what pleaſing variety! Trees, which bear apples, cherries, pears, plums, gooſeberries, currants, raſberries, apricots, peaches, grapes, pine-apples, oranges, lemons, nuts, mulberries, quinces, &c. What an indulgent parent! who hath not only made ſuch rich proviſion, for our neceſſities and bare ſupport—but even for our enjoyment and pleaſure:—to pleaſe our palate, to refreſh, to cool and allay our thirſt, during the parching heat of ſummer.—Neither muſt we here forget the variety of garden plants and herbs, for our table. The ſpinach, the cabbage, the ſprouts, the cauliflower, the lettuce, the artichoke and the aſparagus.—And the uſeful roots, the radiſh, the onion, the turnip, the carrot, the potatoe—and many others.

PUP. I hope I ſhall always love and eſteem ſo kind and ſo gracious a benefactor—and prove my gratitude ſincere, by my unceaſing attention to conform to his divine will, in every thing.

TUT. This I do aſſure you would rejoice my heart—and the hearts of your affectionate parents. God grant this may be the happy fruit of theſe inſtructions, not only to you, my dear pupil, but to all who may peruſe them.

PUP. How is fruit produced?

TUT. In many plants, the fruit proceeds from the ſame part where you ſee the bloſſom has been.

But in the ſmall nut, and the cheſnut trees—in the Turkiſh and Indian corn, the fruit comes where the bloſſom has never been; otherwiſe almoſt all fruits are preceded by bloſſoms. But the fig comes to perfection without a flower. And in melons, cucumbers, and ſome others, the fruit is ſeen before the flower.

Pup. How is the fruit preſerved?

Tut. By the ſhell or rind—but it is not the ſame in all. In melons and cucumbers, this is very thick, in others very thin. Thoſe lying near the ground, would otherwiſe be deſtroyed by inſects. And grapes could not be eaſily preſſed, if their ſkin or rind was like that of the melon. The peach and the plumb, are appointed for our refreſhment, at the cloſe of the violent heats. Their uſe being limited to a ſhort period, their clothing is adjuſted, accordingly, and a thin ſkin is ſufficient. The apple and the pear, which are deſigned to be continued through the winter, have a covering of a more compact contexture. For which reaſon cheſnuts and other ſpecies of nuts, are preſerved in a ſtill more ſecure manner. The cheſnut in its infant ſtate, is ſecured from the birds, as is the gooſeberry by prickles.—And the walnut, which in its immature ſtate furniſhes our tables with ſuch a fine pickle, would probably be deſtroyed in its infancy, if it were not ſecured by the bitterneſs of its rind.

Pup. And where are to be found the ſeeds of theſe fruits?

TUT. As they are very precious for the propagating of their reſpective ſpecies, they are placed within the fruit, in a ſafe repoſitory. Some in a hard ſtone—others with glazed walls.—One of the moſt curious which I have ſeen, is the coſſia.

PUP. How can we beſt judge when fruit is ripe?

TUT. By the colour, and by the fading of the ſtalk, or when with a gentle touch, they are eaſily looſened from the branch.

DIALOGUE XVI.

OF FLOWERS.

TUT. Suppoſe we now walk into the flower garden.—See, what a beautiful ſight! What variegated colours! How pleaſing to the eye! How fragrant to the ſmell!

PUP. May I aſk you what are thoſe properties of flowers, which I ought more particularly to notice?

TUT. Flowers are diſtinguiſhable, by their beautiful colours, their variety, and by their fragrant ſmell.—Nor are they merely ornamental, but moſt of them very ſerviceable.—It may juſtly fill you with admiration, that from green plants, ſo many fragrant flowers ſhould ſpring up—that from a bulb of no very pleaſing form, ſhould ariſe ſuch variegated tulips—or the beautiful ranunculus, from a dirty little claw: this, unleſs we had ſeen, we could never have believed.

Pup. Of what ſort are their colours?

Tut. Of all ſorts. Sky blue, ſea green, common green, olive green, purple, yellow, orange, crimſon, red, violet, roſe colour, mouſe colour, aſh gray, ſilver colour, &c.

Pup. What have you to obſerve concerning their ſmell?

Tut. This conſiſts in the fragrance ariſing from the juices, and from volatile parts, which are continually exhaling out of the ſmall evaporating tubes of the flowers, or from the leaves.

Pup. Which excel moſt in fragrance?

Tut. Violets, July flowers, woodbines, roſes, lilies, auriculas, &c.—The very mention of which almoſt renews their fragrance. Some wild heath flowers, and field flowers, have alſo a peculiar flavour.

Pup. You have ſaid that they are not only ornamental, but uſeful?

Tut. Yes, flowers cheer the drooping, and refreſh the wearied ſpirits; they yield us fruits and ſeed.—And particularly honey, oil and wax, ſnuff, perfume, paint and medicines.

Pup. But ſome flowers have a diſagreeable ſmell.

Tut. They may thereby poſſibly correct or abſorb the noxious vapours. They may ſerve for food, to ſome animals and inſects, or they may have ſome medicinal virtues.—With all our boaſted knowledge, we have not yet diſcovered all the excellent uſes either of herbs or flowers.

Pup. What a kind and indulgent providence!

Tut. And what a ſtrong argument to truſt in divine providence, has our bleſſed Saviour drawn from even that part of nature we are now contemplating!

"And why take ye thought for raiment? conſider
"the lilies of the field, how they grow? they toil
"not, neither do they ſpin; and yet I ſay unto you,
"that Solomon, in all his glory, was not arrayed
"like one of theſe. Wherefore if God ſo clothe
"the graſs of the field, which to-day is, and to-mor-
"row is caſt into the oven, ſhall he not much more
"clothe you, O ye of little faith."

DIALOGUE XVII.

OF SEEDS.

Pup. By what means are plants and flowers preſerved and increaſed?

Tut. Each plant produces a great quantity of ſeed which preſerves it to future generations. Some ſeeds are ſo ſmall as to be ſcarcely viſible.

Pup. Where are theſe ſeeds to be found?

Tut. In ſome, in the top of the plant, in others, in the middle of it, and again in ſome between the leaves, or under them. They are found in little huſks, or in convenient partitions, ſeparated from each other by a thin ſkin. Others ſtand in order together, as in the ſun flower.—Does it not appear to you aſtoniſhing that ſuch great plants as trees ſhould ariſe from ſuch ſmall ſeeds?

PUP. It does indeed—and yet if they were larger they might injure us by the fall. I remember very well the fable of the acorn and the philoſopher.—But does one plant, or tree, produce many ſeeds in one ſeaſon?

TUT. This is very various.—In ſome more, in others leſs. A tobacco plant has been known to produce more than forty thouſand ſeeds.—An elm tree more than three hundred thouſand annually.

PUP. And why ſuch an amazing number?

TUT. Hereby is a great proviſion made for the fowls of the air. If they were once all conſumed, which might eaſily be the caſe, how could we ever recover them again, if there were not ſuch a great increaſe? Admire this diſplay of divine power, wiſdom and goodneſs. For without ſuch a proviſion, the birds muſt half of them periſh. Food in that form, and ſmall compaſs, can more eaſily be preſerved for their winter food.

PUP. How do the ſeeds come out of the pod?

TUT. In dry weather, when the pods are wither'd, they open, and the ſeeds being dry, they eaſily fall out upon the ground: and thoſe ſeeds which are not gathered ſink into the earth, with the rain.

Pup. What becomes of the lighter ſeeds?

Tut. They are carried about by the wind—and fall when the wind ceaſes. For this reaſon, we ſee plants upon high old walls and towers; becauſe ſeeds, falling between the crevices of the ſtones often grow. Birds alſo, in carrying them, may frequently let them fall in their flight. And beſide this, nature has furniſhed ſeveral of them with ſoft down, which ſerves inſtead of wings to convey them through the air, to diſtant places.

Pup. How long will ſeeds continue fit for growing?

Tut. Several years, for ſometimes wet ſeaſons come on, when ſeed cannot be gathered in—and then we muſt have recourſe to the old ſtock.

Pup. What makes the ſeeds ſprout forth?

Tut. Moiſture and warmth, which cauſe a fermentation in the meal, or flour of the ſeed, and give the firſt nouriſhment of life to the ſprout therein encloſed. This no ſooner makes its appearance, than it caſts off its huſk, ſends forth a root, and receiving more nutrition it ſhoots up, and gradually riſes to perfection.

Pup. Do ſeeds anſwer any other purpoſe than thoſe which you have already mentioned?

Tut. Yes, ſome ſeeds are food for man, and for beaſts, as well as for birds.—They alſo yield us oil for painting—and provide us with what is of a medicinal nature.—From which we learn that the ſmalleſt things are not to be overlooked, or deſpiſed, being often found exceedingly beneficial.

DIA-

DIALOGUE XVIII.

OF THE SEASONS—OF GRASS, CORN, &c.

Pup. What opinion am I to form of the changing ſeaſons?

Tut. That they are ordained for wiſe purpoſes: to promote vegetation, and make men induſtrious.

Pup. Should not we be better without the winter ſeaſon?

Tut. By no means, even the winter (the ſeverity of which we feel ſo ſenſibly) lays the foundation for our future ſuſtenance, by making the earth more productive. And froſty weather contributes to our health.—The earth muſt have reſt too as well as man. So that we ought to be thankful for the winter's cold, as well as the ſummer's heat. And beſide this, when it is winter with us, in the northern part of the globe, it is ſummer with the inhabitants of the ſouthern hemiſphere. And ſurely we are not ſo ſelfiſh, as to wiſh to monopoliſe all the favours of heaven to ourſelves.

Pup. But ſpring! I am delighted with the ſpring.

Tut. Have you conſidered why the ſpring ſo much delights you?—It is partly owing to the winter you have ſo lately paſt through: your having juſt then emerged out of that rigorous ſeaſon gives you a more lively perception of the happy change. As a ſevere fit of ſickneſs gives additional enjoyment to reſtored health. The ſpring yields you ſingular pleaſure as a time of promiſe. What appeared dead before, begins then to aſſume new life; and preſents you with the pleaſing hope of the ſucceeding fruitful ſeaſons: the proſpect of the ſummer, which in proceſs of time, raiſes every thing to its full maturity: and the proſpect of harveſt, which not only rewards the toil of the huſbandman, and furniſheth us with proviſion for the time preſent, but alſo ſets before us our winter ſtore, that fear of future want may not diſtreſs us.

PUP. Which are the moſt uſeful products of the earth?

TUT. Graſs and corn. God cauſeth graſs to grow for the cattle—and bread, which ſtrengtheneth man's heart.

PUP. What is there particularly obſervable in the graſs?

TUT. That it grows ſpontaneouſly without the help of man, affords ſufficient food for the beaſts of the field, and covers the upper ſurface of the earth as with a carpet, very pleaſing to the eye.

PUP. But what proviſion is there for the cattle in the winter?

TUT. Part of the graſs is mown and dried, which is then, you know, called hay, and ſerves for their winter food. The graſs is in ſome ſeaſons cut a ſecond time:—or it remains in the field, for the cattle's ſubſiſtence after harveſt, in which ſtate it is in ſome places called eddiſh.

Pup. Which are our principal grains?

Tut. Wheat, rye, barley, oats, beans, peas, &c.

Pup. Of what uſe are the long ſtalks?

Tut. That the ears may not eaſily be beaten down upon the moiſt ground. They furniſh the huſbandman alſo with ſtraw, for various purpoſes.

Pup. For what purpoſe are the ſtalks ſo ſmooth?

Tut. That the rain may eaſily run off, and not rot them.

Pup. Why have the ſtalks knots and ſhoots, or blades?

Tut. That they may not be broken in the open fields, by the violence of the winds.

Pup. Why are they thus pointed and flexible, or waving?

Tut. The birds would otherwiſe ſit upon them at their eaſe, and pick out the grain; and that too before it was ripe.

Pup. For what reaſon do they ſow wheat and rye before the winter

Tut. That they may have time for growth. The blade appears time enough before the winter, to ſtand againſt the wind and weather—the valuable ear does not then expoſe itſelf to the violent ſeaſon—but waits for warmer weather—and then riſes to perfection.

Pup. How do the young plants endure the bleak weather?

TUT. They are richly ſurrounded with blades, like thoſe of graſs, which in the ſpring of the year fall off in the warm weather—and then the plant feeds and flouriſhes.

PUP. How is it with the grain?

TUT. The kernels of the grain are ſecurely lodged in ſtrong huſks, or chaff, that the ſun (after the corn ſhoots out in the ear) ſhould not ſcorch and ſhrivel it, or the rain and dew cauſe it to rot.

PUP. And what farther?

TUT. Alſo that in time of harveſt, the grain may not be ſhook out and loſt, as the huſbandman is bringing it into the granary.

PUP. How do the ears of corn grow, and how do they ripen?

TUT. When the dew and rain have made them ſwell, the enlivening ſun dries them by degrees through the whole day. By theſe means they become fully ripe, and eſpecially when after reaping, the ſheaves ſtand ſometime in the field.

PUP. And what is the produce?

TUT. We have never ſuch abundance as to render it of little value; or ſuch a ſcarcity, that men and cattle periſh for want of it. A demonſtrative proof of a divine providence.

PUP. But ſuppoſe there is a failure in the crop?

TUT. When that happens in one place, other countries are generally able to ſupply the deficiency, which has lately been the caſe in France; a great ſcarcity prevailing there, whilſt in other nations there was a very plentiful harveſt.

PUP. What is the fruitfulneſs or product of each ſtalk?

TUT. The produce is almoſt incredible; I have been informed, that from one grain of wheat, have riſen one hundred ſtalks, bearing ears, which yielded in the whole two thouſand grains.

PUP. Almoſt incredible indeed! But this I ſuppoſe does not often happen?

TUT. Their different produce depends much upon the nature of the ſoil—upon good huſbandry—the nature of the ſeed, and the manner of ſowing it.

PUP. In what other reſpects, do we ſee the wiſdom and goodneſs of God in grain?

TUT. That it can be preſerved in granaries, and continue good for ſome years of bad harveſt. Many other fruits of the earth cannot be preſerved one year—and ſome not one month, and others not one day after they are fully ripe. Neither is there any herb or plant of the field which affords us ſuch a wholeſome nouriſhing food. With bread we are never ſatiated. It is juſtly called the ſtaff of life. And yet how inſenſible are we of its value—how little thankful for bread? O may we never incenſe the Almighty, by our ingratitude, to teach us the worth of it, by withholding from us the fruits of harveſt.

PUP. Of what uſe is barley?

Tut. Of this malt is made, from which we brew ale, beer, and alſo porter, nouriſhing ſtrengthening liquors, eſpecially for the labouring part of mankind.

Pup. What uſe is made of oats?

Tut. In ſome countries, particularly in the northern parts of Great Britain, the common people make a wholeſome bread of this grain.—But it is generally given to cattle, particularly to horſes, without being ground into meal.

Pup. Which are the moſt uſeful plants of thoſe which are not deſigned for food?

Tut. Flax and hemp. The former, which the Dutch in particular cultivate with great care, is very profitable to the farmer, and very uſeful to the world at large.

Pup. In what reſpect?

Tut. The ſeed yields oil, and the fineſt of our linen is made from the rind of the ſtalk.—And when that fine linen is much worn, do you think that it is of any farther ſervice?

Pup. I have heard that fine rags are a very acceptable preſent for hoſpitals.

Tut. So they are—but would you think that we make our fineſt writing paper of ſuch rags?

Pup. Make paper of rags! How is that done?

Tut. When ground ſmall, they make of it a pulp, or paſte, with water and ſize, and pour it into flat moulds, from which we receive one of the moſt uſeful articles of buſineſs. The coarſer paper is made of coarſer rags.

Pup. That is a curious manufacture indeed, which I ſhould wiſh to ſee.

Tut. In our next walk, we will ſtep into the paper mill—and ſhew you the whole proceſs.

Pup. And what uſe is made of hemp?

Tut. Of this they make the coarſeſt kinds of cloth, for ſails, ſacks, &c. And of this is made our ropes and cables for ſhips.

Pup. The farther you proceed, the more I am amazed at the very ample ſtore of good things, which God hath provided to ſupply the manifold wants and neceſſities of mankind.

Tut. The whole world is a ſtorehouſe, or grand magazine, furniſhed with every article that we have occaſion for.

" O Lord how manifold are thy works! The earth
" is full of thy riches."

CONCLUDING DIALOGUE.

OF THE PRODUCE OF OTHER COUNTRIES, AND THEIR USE IN MERCHANDISE.

Pup. What advantage have we from the produce of the other parts of the world?

Tut. As every land has its own particular produce, by means of navigation one country partakes of the produce of another. And thouſands gain their livelihood by ploughing the ocean, as the farmers do by ploughing the earth.—I will mention to you here ſome of the principal articles of merchandiſe, the production of the four quarters of the world, as it may probably be of ſervice to you in future life.—And if you be not a merchant, it is ſtill proper, as a perſon of a liberal education, that you ſhould know them.

PUP. You will oblige me.

TUT. From *South America* (by the way of *Spain)* we receive gold, ſilver, quickſilver, peruvian bark, and balſam of Peru—Immediately from Surinam, cocoa, cotton and coffee.

From *North America,* tobacco, pipe ſtaves, ſkins, furs, tar, pitch and reſin.—From the *Weſt Indies,* rice, ſugar, coffee, cotton and indigo.—From the *Eaſt Indies,* cinnamon, cloves, nutmegs and pepper, tea, china, japan-ware and ſilks.—From *Africa,* gold-duſt, ivory, olives, palm wine, ſalt petre, leather, gums and drugs. From the *Levant,* cotton, raw ſilk, rhubarb and oil.—From *Spain, Portugal* and *France,* our beſt wines,—oranges, lemons, figs, prunes, raiſins, and cheſnuts.—Fine wool is alſo exported from Spain, and the ſteel of Biſcay and of new Caſtile is judg'd to be the beſt in Europe.—The *Madeira* and *Canary Iſlands* are alſo well known for their excellent wines, which the hotteſt weather, ſo far from impairing, greatly mellows and improves.—From *Great Britain,* wool and iron (manufactured) tin, lead, coals, earthen ware, wheat, barley, malt, oats, ale, porter and cyder.—From *Ireland*, butter, ſalted meat, and manufactured flax, well known by the name of Iriſh linen.—From *Norway*, *Sweden* and *Denmark*, maſts, oak planks, fir timber, ſtock fiſh, copper, iron, furs, ſkins, pitch and tar.—From *Germany*, rheniſh wine and hock, foreſt timber, and wood for fuel.—And the juniper-berry, uſed in the making of geneva, the beſt of which is made in Holland.—From *Ruſſia*, hemp, flax, turpentine, pitch, tar, furs, hides and tallow.

PUP. And what is the chief produce of the Seven United Provinces, for exports?

TUT. Flax, hemp, madder, butter and cheeſe, great quantities of which are exported annually. Many thouſands alſo of lean cattle, which are purchaſed in the north, are fed in theſe low countries, which afford an almoſt inexhauſtible ſtore for the navy, for merchant ſhips—and for exportation.

PUP. You have very juſtly ſaid, that the whole world is a grand ſtore-houſe for man. How thankful ought we to be, that though there are ſo many millions of inhabitants on the earth, yet enough is provided for all—and in ſuch abundance too, as totally to baniſh the diſtreſſing apprehenſion of want.

TUT. Your reflection pleaſes me, as it ſhews you have not been inattentive to my inſtructions. You alſo perceive the great benefits of commerce—by which we obtain the productions of the moſt remote parts of the globe. So that not only our own country, but the whole earth contributes to the ſupply of our neceſſities, convenience, and pleaſure. The natives of one country, not only labour for themſelves, but for other countries—and others again for them—and by theſe united efforts, accompanied with a divine never-ceaſing co-operation, the whole world is ſupported.

I have now, my dear pupil, drawn your attention to the principal parts of nature, as far as your young mind is capable of comprehending them.—I hope this ſlight ſketch will excite you, with your riſing years, to purſue theſe inquiries, to enlarge your knowledge of the glorious works of Nature, and thereby engage you to love the God of nature,—to ſerve him—and to magnify his name.

" Aſk now the beaſts, and they ſhall teach thee,—and the fowls of the air, and they ſhall tell thee.—Or ſpeak to the earth, and it ſhall teach thee.—And the fiſhes of the ſea ſhall declare unto thee.—Who knoweth not in all theſe, that the hand of the Lord hath wrought this? "

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